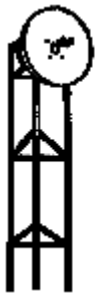

SAN BERNARDINO MICROWAVE SOCIETY, Incorporated

FORMED IN 1958

A NON-PROFIT AMATEUR TECHNICAL ORGANIZATION DEDICATED TO THE ADVANCEMENT OF COMMUNICATIONS ABOVE 1000 MC.

W6IFE Newsletter

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The 6 April 2000 meeting of the SBMS will have Jeff, KN6VR leading a panel discussion on "A receiver evaluation tool" software excel spreadsheet. The SBMS meets at the American Legion Hall 1024 Main Street (south of the 91 freeway) in Corona, CA at 1900 hours local time on the first Thursday of each month. Check out the SBMS web site at http://www.ham-radio.com/sbms/.

REMINDER Nominations and elections for SBMS 2000-2001 officers will take place in April.

Last meeting Gordon Huff, WA6FMX had a great tech talk about the design of talk on solid-state T/R circuits. Included in this month's newsletter are some of the circuits Gordon talked about which used pin diodes. Thanks for the good talk Gordon. Nominated for office were President: Doug, K6JEY and Jeff, KN6VR; VP Dick, WB6DNX and Jeff, KN6VR; Recording Secretary, Mel, WA6JBD; Corresponding Secretary, Kurt K6RRA; Treasurer, Dick, K6HIJ. 19 present.

The Annual SBMS Dinner was held on 4 March at Cask and Cleaver Restaurant in Victorville, CA. Due to the large amount of rain in the Southland only Jeff, KN6VR and wife; George, K6MBL and wife; Larry, K6HLH and wife; and Chuck, WA6EXV and wife were present for the good food and service. Lots of good conversation was had by all. Thanks to Jeff for planning the dinner event.

March 2000 QST reports the results of the 10 GHz and Up Cumulative Contest. I see that SBMS members took the top places with John, WD4MUO/0 being high point with 44,625 in the 10 GHz only category followed by Jack, N6XQ with 19,739 points. Jack is also a member of the San Diego Microwave Group. The 10 GHz and Up category was lead by Dave, WA6CGR with 27,965 points. SBMS plaques should be in the works now that the scores have been published. Ed, W6OYJ took a nice picture of Kerry, N6IZW with gear on the air that was printed in the article. The East Coast and Midwest groups are now picking up more points than they have in the past along with a larger group reporting scores. I know there were more Western stations on the air from my logbook, but the ONE page QST article shows that not everyone is turning in scores. How can we show activity if people don't turn in the data? I know my limited time this year only permitted one weekend operation and my score reflects that. My scores in some of the other VHF events are usually the bottom ones in SJV section, but hey, I was on the air using the bands. From some of the professional magazines I receive, it sounds like the FCC is being pushed to again "sell" the spectrum to the cell phone, computer LAN, and other want-to-be users. If we aren't active, why have the bands?

In the March/ April issue of QEX magazine is another super article by John Stephensen, KD6OZH. This time it is "The ATR-2000 A homemade high performance HF transceiver PTI". Glad to see it John!

Scheduling-

4 May TBD

1 June TBD

10-12 June VHF QSO Party

29 July - A joint SBMS, San Diego Microwave Group rig field measurement party.

Address changes for Owen Wormser; K6LEW is 3201 Tennyson St NW Washington, D.C. 20015 with phone 202-362-8255.

Wants and Gots for Sale

For Sale X-band waveguide pieces and coax to WR-90 transitions and some WR-62 pieces of waveguide Jeff KN6VR 714-577-0045

Want WR-42 90-degree twist and WR-42 waveguide switch Dave WA6CGR 909-318-5154.

Want 5 GHz brick Ken WB6DTA 818-848-9059

Want 3"piece of WR-42 w/ flanges Doug, K6JEY 562-424-3737

Activity reported at the March 2000 SBMS meeting Chuck, WA6EXV has been working on a Qualcomm 10 GHz rig with dual frequencies for Phase 3D and the 1 w power amp; Bill, WA6QYR has been cutting Qualcomm aluminum disks and working on tuning one of the 10 GHz 1w power amps; Ed, W6OYJ reported that San Diego Microwave Group (WB6BKR) has been working on a faulty 24 GHZ gunn diode and WB6IGP and N6IZW have been working on some large LED communication rigs; Ken, WB6DTA and bob, W6SYA have been working on a signal generator; Mel, WA6JBD finished his nice looking 24 GHz gunnplexer with temperature controller and IF preamp all located in a RF tight box; Doug, K6JEY finished up his 24 GHz antenna when a friend of Hiro's in Japan bent up a WR-42 feed; Kurt, K6RRA has been drilling and assembling his IF receiver boards; Gordon, WA6FMX has a Direct TV dish; Dave, WA6CGR had a 1.2 GHz linear, wideband test amplifier 2 mw in 10w out using Mitsubishi power modules to show and was recognized for being number 1 in the 10 GHz and Up Contest.

On another subject - I built a pair of LED communicators, which Chuck, WB6IGP and I have checked out with a two way over 2 miles. It consists of a 5000 mcp red led turned on & off at 35 KHz with the drive from a VCO which is modulated with NBFM audio. The receiver is a modified older I/R remote control unit, which has no IR filter in front of the PIN detector and so responds well to the 660 nm LED output. I am using 12" of 4" sewer

pipe for the collimator with a Fresnel lens cut out from a sheet reading magnifier. The received signal is amplified by the IR remote unit as a preamp & then up converted to 145.035 MHz using an SBL-1 mixer and 145 MHz PLL. I use a 2M all mode receiver for the IF and can use SSB mode for locating a weak carrier and then switch to NBFM for voice. I did a one-way check by myself to a roadside reflector at 2.2 miles & had full quieting while holding the assembly by hand (no tripod). The main idea is to come up with an optical communicator which is easy to point (about 1 degree beam width) and does not have the high intensity hazards associated with someone accidentally being distracted or momentarily blinded by a laser (cares, planes, pedestrians). We expect to be active during the next 10 GHz & Up Contest! I do believe we can do at least 1 KM even in daylight but the range is much better in lower light (may look at trying Rx optical filter). 73 - Kerry N6IZW

"Transmit/ Receive Switches" Tech Talk by Gordon Huff, WA6FMX" at the 2 March 2000 SBMS Meeting.Coaxial relays are the usual transmit/ receive switch in an amateur microwave rig, but they are costly and for the most part hams end up with a 28-volt version from the swap meet that needs another power supply voltage. Many hams believe PIN diode switches are lossy and for low power only. This is not always true. I worked for a company (in the past) who built aircraft IFF transponder TR switches at the 1 & 4 kW power levels, which had a 0.12 dB loss in the 1.1 GHz frequency band.Many hams are unclear on how a diode can act as a switch. Figure 2 is a diode transfer curve and elaborates how a change in dc operating point can switch an ac signal on and off.

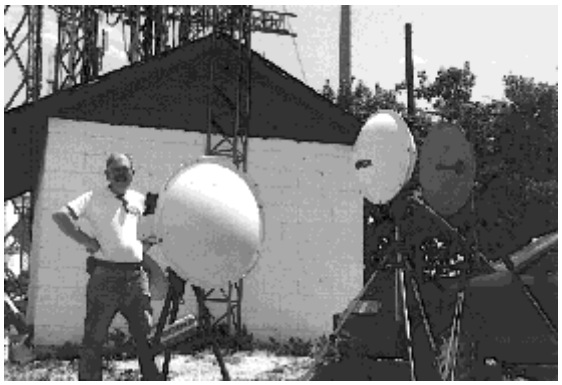
Figure 3 shows two representative switch circuits. Ramsey and MFJ rigs use circuits like this series or conductive PIN diode switches - which tended to be lossy.Figure 4 elaborates on the structure of the PIN diode and compares it to a typical transistor built with planar epitaxial technology. The PIN diode is made up of a piece of semiconductor that has been doped P on one end and N on the other with intrinsic material in the middle. Between the size, geometry and lack of a "junction" the PIN diode is inherently a high voltage part. This also means the role of minority carriers in a PIN diode is different and, therefore, there is a frequency above which diode action is not possible and where the ac and dc specifications of the diode are different. They use high voltages to bias them properly in high RF environments. Reverse bias in the 1 kW switch was 55 volts. Reverse bias in the 4 kW switch was 70 volts with less than 1 ma per diode. Figure 6 uses round numbers to emphasize what we're doing. In a 50-ohm system, 800 watts is 200 volts at 4 amperes. The 1 kW switch used PIN diodes rated at 200V dc to switch 225V ac. (This is not a typo.) How good a switch is a PIN diode? On resistances are in the 10 to 15 ohms and reverse resistance is in the 10K region. A switch circuit with about 30 dB isolation is not good enough. The 1 kW switch used two PIN diode circuits in series. The 4 kW switch also used two PIN diode circuits in series but in a balanced configuration that used twice as many diodes. PIN diodes work well in the microwave regions but have a low frequency limit related to their relaxation time which is a consequence of the solid state materials used. This limit is typically 60 MHz. Figure 5 shows a shunt or reflective switch from the Radio Amateurs Handbook about 1978. The theory is that transmitter power causes the (signal-type) diodes to conduct and a quarter-wave of coax about 13 inches at 2 meters - shows high impedance at the transmitter end. The 1978 parts limit this switch to about 1 w. With the correct parts and correct dc bias, this circuit is ok to several kilowatts. In the 1980's some switches like this had problems with harmonic generation. One of the boxes mentioned at the meeting was the Heathkit 2 meter power amplifier, which apparently had problems radiating third harmonic in the 440 band in addition to operating in the 2-meter band. This would be a consequence of signal-diodes in the switch a PIN diode in this application does not have "diode" action and is a pure resistance.Figure 6 is part of the 1-kw switch. It has two tuned sections and two PIN diodes in series. The transmitter power at the receiver is reduced from 61 dBm to about 0 dBm. An additional more-or-less tuned section uses several signal type diodes, which I think protect the receiver from other near-by transmitters. Figure 7 recapitulates the numbers in this talk. The PIN diodes were rated 200V 4A and were a Unitrode catalog item. (PIN diodes are available to 10,000 V!)Figure 8 describes what the 1-kw switch was asked to do. An IFF box switches the transmitter output from antenna sum port to antenna difference port and back in a microsecond time frame. An IFF box listens between pulses. This IFF box drove a phased-array antenna with many ports. The full TR Switch used 17 PIN diodes and, I think, 28 signal diodes. A final note. The 1 kW switch is tuned precisely to frequency with small copper pieces and an orangewood stick. A network analyzer was connected to the antenna port and terminated the transmit and receive ports. Bias the PIN diodes were tuned on. The unit was tuned with

the copper pieces. This was done for each port. When all the matches are good, the insertion loss was typically 0.12 dB.

RE: Having fun with through the air optical communicationThe ARRL 10 GHz & Up contest held each year also includes optical communications over a minimum distance of at least 1 Km. I played with low power lasers a few years back & did not like my first experience at trying to communicate over a 2 mile path. We were using surplus 5 mw lasers mounted on heavy-duty camera tripods & spent probably most of an hour trying to aim one of the lasers at the receiver at one end (we finally did make it). The pointing was way too critical for standard pan/tilt tripod adjustments and when we did get on target, the intense laser light left Chuck, WB6IGP with a headache for two days. Two weeks ago I decided to try again using current LED technology for the transmitter. I constructed one transmitter consisting of a Radio shack red LED rated at 5000 mcp @ 20 ma (660 nm) at one end of a 12" long, 4" diameter plastic sewer pipe housing with a Fresnel lens cut from a sheet reading magnifier on the other end. The LED is driven by a power FET connected to the output of a 4046 PLL IC running as a VCO at 35 KHz. This provides a 30 ma average square wave drive to the LED. An electret microphone and an op amp provide audio to modulate the VCO for NBFM communication.The receiver consists of the same lens/pipe arrangement with modified surplus I/R remote control receiver. The I/R receiver was chosen, as it appears to have a nice large area PIN photo diode with no I/R filter in front. The unit circuitry was modified to provide linear output as a preamp rather than providing a digital output for control purposes. The received 35 KHz from the preamp is upconverted to 145.035 MHz through a simple up converter consisting of a 3036 PLL circuit and an SBL-1 mixer. This allows the use of a standard 2M radio as the NBFM receiver. It also allows a 2M all mode radio to be used in SSB mode for weak signal detection and initial alignment. The initial testing and alignment was performed using a bicycle reflector mounted out about 250'. The transmitter & receiver were mounted on separate tripods with a rifle scope mounted each tripod as well which was adjusted to point at the red spot returning from the reflector when the received signal was maximized. There are noticeable problems with parallax at this distance. Pointing the two units at each other over the 250' distance and measuring the carrier to noise followed this. The values indicated the system should be capable of perhaps 4-8 miles.I completed two transceivers with the help of Chuck & we tried an across the yard shot which was of course very easy with full quieting of the FM receivers. On 2/24 we set up about 2.2 miles apart and tried again. The hardest part was spending a few minutes locating each other as Chuck had moved to a location on Mt Helix, which was not where I was expecting him. We briefly used strong flashlights (and 70 cm radios) to locate each other and aligned the scopes on the transceivers to the flashlight spots. We immediately had useable signals, which were improved to full scale S meter deflection & full quieting upon additional position adjustment. The red spot is very noticeable but not at all hard on the eyes and the pointing is very reasonable for a good tripod setup (same tripods we use for our microwave contacts). Using a calibrated S meter on my end showed the carrier to noise to be still at least 14 db so we'll try 4+ miles next & are easily ready for a few contacts during the August/September contest. The contact was made at night & I believe we can make at least the 1 km during daylight as well. 73 - Kerry &endash;

A Trip to San Diego--- Judy, KC6UTF and I, WA6QYR traveled to San Diego on 16 March for a short vacation. Ed, W6OYJ was nice enough to take me around to some of the local surplus electronics stores on Friday. On Saturday, Ed had arranged for several of the local San Diego Microwave Group to be out and about for some 24 GHz contacts. I set up on the standard Mt. Soledad and quickly learned about the problems of being a strange looking amateur radio operator in a high visibility tourist area. It is hard to work other stations while answering questions about what you are doing to the general public. Tour buses come by bringing a load of people who have questions. Cars of tourist come by with questions. Any way I made contact with W6OYJ on a couple of miles in the beach haze. Kerry, N6IZW was out on a hilltop some 12 miles away with his 100-mw gunnplexer. Later in the weekend we got together for dinner at one of the seafood places. I was able to make one of the San Diego Microwave Group meetings at Kerry's house on the Monday night. 17 people were present for a demonstration of the N6IZW/ WB6IGP LED communications equipment over a 2-mile path. Chuck, WB6IGP will be publishing the rig in 73 Magazine soon. There was lots of show-and-tell at the meeting and all had a good time.

73 Bill, WA6QYR



Dick, WB6DNX on Heaps Peak in 1997. Photo via George, K6MBL files

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San Bernardino Microwave Society newsletter

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